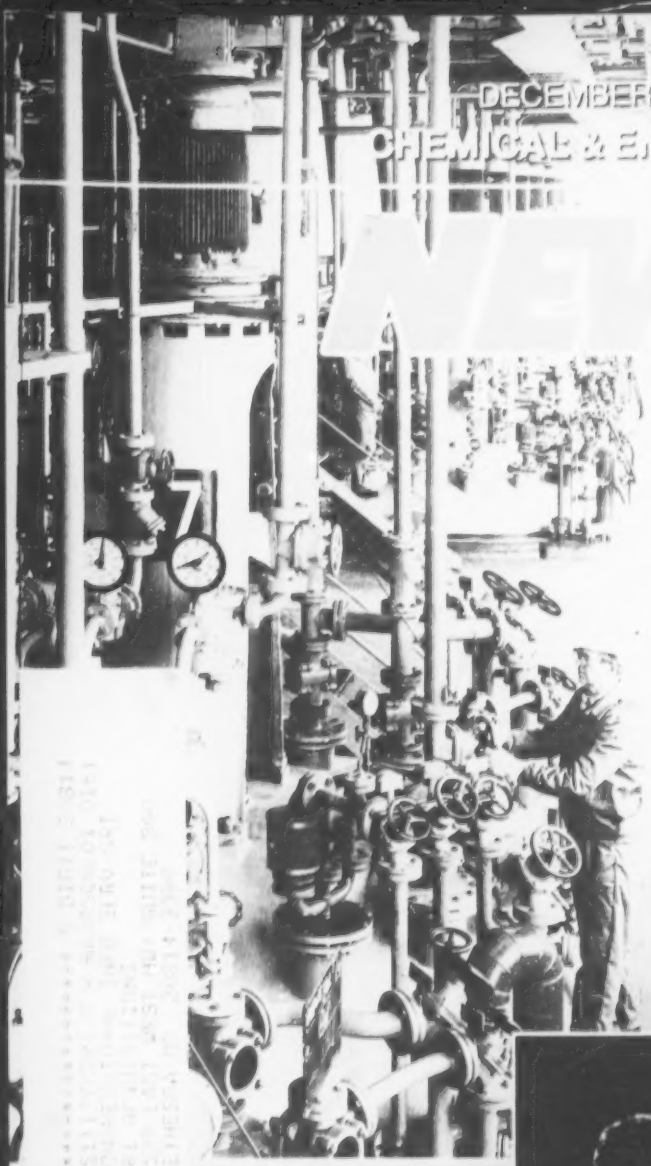
DECEMBER 10, 1990
CHEMICAL & ENGINEERING

Global Chemical Outlook



CHEMICAL & ENGINEERING
NEWS
DECEMBER 10, 1990

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News of the Week

■ **CMA survey shows chemical makers upbeat about 1991 despite softening of U.S. economy and uncertainties generated by Persian Gulf crisis.** Page 6

■ **Progress in domestic and international efforts to map the human genome was described at meeting of genome project officials and advisers at NIH last week.** Page 6

■ **NSF's Presidential Young Investigator awards program may face cuts of 50% or more, with awards going to more experienced researchers.** Page 7

■ **ACS Board, meeting in Washington, D.C., reelects Joseph A. Dixon as chairman, takes action on several matters.** Page 7

■ **Arco Chemical president and chief executive officer Harold A. Sorgenti has unexpectedly announced his retirement, effective next June, and will be succeeded by Alan R. Hirsig.** Page 8

Business

Prices and demand for aromatics will likely weaken after unusual price upswing earlier this year as a result of the Middle East crisis. **Page 11**

Government

Although federal funding of chemical R&D went up during 1980s, increases for chemistry have not kept up with those for other disciplines in recent years. **Page 14**

Science Policy

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Science/Technology

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World Chemical Outlook

Chemical companies throughout the world are concerned that easing demand for their products, coupled with rising capacity, will undercut prices at the same time that petrochemical raw material costs escalate as a result of tension in the Mideast. Page 24

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LETTERS

CHEMICAL SAFETY

Synthesis of nopinone

As mentioned by Patrick M. Gordon in his letter (C&EN, Aug. 6, page 2), we also had problems trying to synthesize (+) nopinone.

After running the reaction successfully many times, in small scale, using acetic acid and sodium iodide or acetic acid and zinc for the decomposition of the ozonide, we decided to scale up this reaction.

Four samples of 45 millimoles of β-pinene were ozonized for two hours in CH_2Cl_2/CH_3OH. The four samples were combined and cooled in a water/ice bath, and acetic acid and zinc were added in order to decompose the ozonide.

The solution was concentrated in a rotavap and stored in a freezer for further workup.

When this sample was let to warm up at room temperature, a violent explosion occurred. Fortunately, nobody in our lab was injured.

José Tércio B. Ferreira
University of São Carlos
Brazil

Funding for biomedical research

The recommendations of the Institute of Medicine panel (C&EN, Oct. 8, page 22) regarding the disposition of funding for biomedical research represents a major step backward. While I see much merit in establishing a sliding scale for the funding of investigator-initiated grants, their recommendation to emphasize support for training grants and facilities construction to the detriment of individual research grants smacks of a campaign to provide bicycles to fish. Without adequate support for individual research projects, it is simply not possible to train individuals properly for careers in scientific research. Furthermore, we will continue to send the demoralizing message that the prospects for successful research careers in this nation are slim. This will certainly have a negative impact on the pool of potential trainees, exacerbating an already serious manpower shortage.

Given limited total funding for biomedical research, I see no reason for change in the current mechanism for facility construction (which is largely dependent upon fund-raising by individual institutions). I also perceive great danger in the centralization of research effort through the proliferation of research centers. In the long run, "big science" is doomed without a stable infrastructure provided by investigator-initiated research and training.

It seems significant that relatively few M.D.s become full-time researchers. Thus, the impact of the regressive funding policies recommended by the Institute of Medicine would have little effect on its own constituency.

John M. Schwab
Associate Professor of Medicinal Chemistry
Purdue University

What is a chemical?

Are we chemists partly to blame for the public's lack of understanding of chemicals and the poor public image that chemistry has? Poor science education and poor communication between chemists and the public are certainly contributing factors. The problem of communication is not made easier by the fact that nobody really knows what a chemical is.

The general public thinks of chemicals as unpleasant, smelly, and poisonous substances that should not be allowed to enter the atmosphere or our water supplies even in the most minute amounts. Most people do not think of water or oxygen as chemicals. Food additives are regarded as chemicals, but substances occurring naturally in food are not thought of as chemicals. Some people consider synthetic vitamin C to be a chemical, but not the vitamin C found in lemon juice, or the vitamin C in a bottle labeled "natural" vitamin C.

Complete confusion reigns as to what is meant by a chemical, as is illustrated by an item in Newscripts (C&EN, July 16, page 56), which quoted a press report that "trees would be sprayed this week due to an infestation of gypsy moths and aphids. The material to be applied is environmentally safe since it is an organic compound, not a chemical." We might at first be tempted to smile at the ignorance of the reporter, but we should be alarmed by this typical misunderstanding.

If we search among chemistry textbooks, nowhere can we find a definition of a chemical. If we consult a dictionary we find statements such as, "A substance obtained by or used in a chemical process." Chemists often use the word in the sense of a substance produced by the chemical industry. In this sense, sulfuric

Prices and Demand for Aromatics Reverse Earlier Gains

Early price runup not likely to be long-term plus for aromatics; prices and demand freeze as potential stalemate in Middle East looms

Bruce F. Greek, C&EN Houston

Pricing and demand for aromatics have turned from strong to neutral and likely will further weaken if a stalemate develops in the Middle East situation this winter. Long term, the demand pressure and sudden high prices for aromatics could become only a blip on the curve of the statistics.

The runup in crude oil and fuel product prices has caused similar price increases for the major-volume aromatics—benzene, toluene, and mixed xylenes. Demand for these aromatics rose when hoarding began as it did for most large-volume organic chemicals. For some, selling prices took off, rising more than prices for gasoline (which competes with chemical uses for all of these aromatics).

The crisis in the Persian Gulf has changed what would have been a down year for aromatics demand and a shaky year for prices and profits. Next year's outlook is so uncertain that few industry observers will forecast demand for aromatics without qualifications regarding the various possible developments in the world situation. In the absence of a shooting war, views generally are for weak demand during the first half of 1991, made slightly worse by some inventory reduction.

Inventory reduction is now under way, according to industry sources. The price decline for benzene suggests that the opportunity for a timely inventory reduction has passed. During the initial runup, spot benzene prices had exceeded the contract price. But by November, when the contract price was $2.00 per gal, this had turned around.

During November, the spot price declined to $1.45 to $1.50 per gal by the last week of the month, says Hugh S. Pylant, a senior consultant at Pace Consultants. In late November, the contract price for benzene to be sold in December had not generally been set by sellers. However, it's widely speculated that the contract price will relate more closely to the spot price, as it does when no major event affects demand.

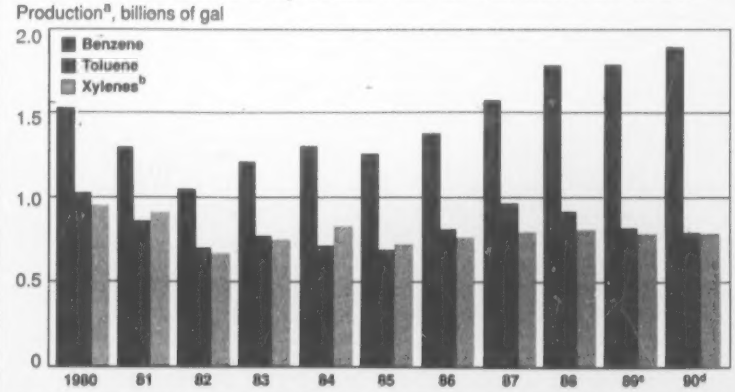
In calmer business times, the price of benzene depends on chemical demand, compared with its value in gasoline, and on the cost of extracting it. The value of toluene, which influences decisions to operate units to hydrodealkylate toluene to make benzene, has minor influence on benzene prices.

Most benzene, toluene, and xylenes consumed in various derivatives come from catalytic reformate, which is made in refineries from suitable crude oil fractions containing precursors of these aromatics. If a chemical need exists, then the aromatics are extracted from the reformate, which otherwise would be blended into gasoline because of its high octane value. Additional quantities of aromatics are extracted from pyrolysis gasoline, a coproduct of ethylene made in steam crackers. Small quantities also are obtained from coking coal. The aromatics are separated in refineries and sold or used in the refinery operations, depending on the better economics.

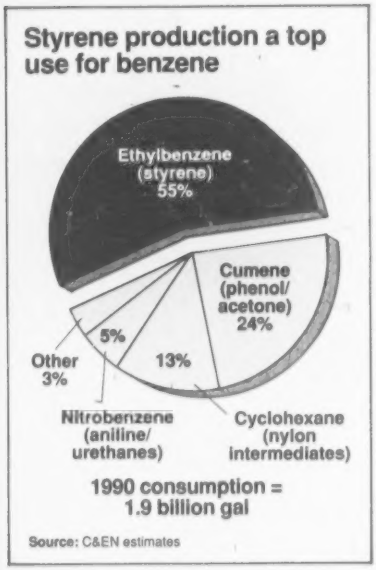
Because of the high benzene demand in chemical uses little of the benzene extracted and purified is blended back into gasoline. However, due to their high blending octane values (100 to 110 and 95 to 115, respectively), toluene and xylenes may be returned to the pool of components blended in making finished gasoline.

Benzene demand growth roughly

Growth in benzene output exceeds that of other aromatics



a All sources as reported. b Includes some ethylbenzene. c Preliminary. d Forecast. **Sources:** U.S. International Trade Commission, National Petroleum Refiners Association, C&EN estimates



follows growth in the economy as it affects demand for durable goods. Benzene production for 1990, however, will total about 1.9 billion gal, says Pylant, up more than 5% over the 1.8 billion gal estimated to have been produced in 1989. However, this growth has been stimulated by some stockpiling during the past four months.

The largest chemical use of benzene is in making ethylbenzene, nearly all of which becomes styrene. Most of the major uses of styrene in polymers are mature products. Growth of the derivatives and of benzene, therefore, will be low, probably about 3% annually, if no special stimulus occurs to spur inventory building. Imports now closely match exports of styrene as capacity comes on stream in other parts of the world. Current styrene supply remains tight because an accident stopped output at Arco Chemical's Channelview, Tex., complex and because maintenance shutdowns and mechanical problems have interrupted other companies' output. Following the rise in benzene prices this summer and fall, styrene prices rose but now have settled back and are holding at 50 to 55 cents per lb.

Cumene and cyclohexane follow ethylbenzene as the largest uses for benzene. The major end products of these derivatives—phenolic and nylon resins—go mainly into houses and commercial buildings. The current weakness in real estate has reduced construction, bringing anticipated lower demand for these uses. Temporarily, therefore, both of these products are expected to have only modest growth in their demand for benzene. Other significant uses of benzene, such as nitrobenzene, alkylbenzenes used as surfactants, and chlorobenzenes, show low growth and will have little impact on any benzene improvement.

For toluene, about 90% of the product produced is never recovered from its sources—reformate, pyrolysis gasoline, and coal tar—since it is used in gasoline production. Of the remainder, more than half is dealkylated to make benzene. Various formulas exist to determine whether toluene costs sufficiently less than benzene so that a dealkylation unit can be profitably operated. In late November, nitration-grade toluene (needed or preferred by many dealkylation plant operators) cost about $1.10 per gal, sufficiently below the price of benzene to make toluene dealkylation profitable.

Part of the reason for the relatively low price for toluene in November stems from a decline in demand for high-octane components for gasoline. The increase in gasoline prices has reduced demand for premium gasoline and, thus, reduced demand for toluene as a blending component. Until motorists decide again that premium gasoline is worth its cost, toluene prices are expected to hold, as inventories are reduced and production is limited.

Similar to toluene, roughly 90% of mixed xylenes produced are estimated to be unrecovered from their sources—also reformate, pyrolysis gasoline, and coal-tar, plus disproportionation of toluene. The recovered mixed xylenes include the three isomers—ortho, para, and meta—along with varying amounts of ethylbenzene. Separation of these materials is difficult and expensive, compared with other petroleum processes. The degree of separation varies widely, with the unwanted components being returned to the gasoline pool. Some of the mixed xylenes are sold as solvents, a use expected to continue to decline.

Normally, *o*-xylene is separated first by distillation. Almost all purified *o*-xylene is converted to phthalic anhydride that is used to make plasticizers for polyvinyl chloride and other plastics. Small amounts go into such diverse end products as herbicides and lube oil additives.

In November, *o*-xylene cost as much as *p*-xylene, or slightly less than 30 cents per lb, which is an unusual situation compared with the past when *o*-xylene cost 20 to 40% less than *p*-xylene. The reason seems to be a slow decline in *o*-xylene capacity during the 1980s with an increase in production of phthalic anhydride, says Teresa A. Acosta, vice president of DeWitt & Co. At the same time, *o*-xylene further replaced naphthalene as the raw material. Consequently, less than 10% of phthalic anhydride now is made from naphthalene.

The decline in *o*-xylene capacity also has affected the export market. In 1980, almost half of *o*-xylene output was exported. At mid-decade, exports declined precipitously and imports rose to exceed exports. A reversal has occurred as imports have declined owing to increased demand elsewhere in the world and to the weakening of the U.S. dollar.

Output of *p*-xylene in the U.S. has been on hold at about 5.5 billion lb during the past three years, largely because of capacity limitations. New capacity to make *p*-xylene in the U.S. has not been built because exports are expected to decline as new capacity is put in place in Asia and because imports of garments made of polyester are rising amid a shift toward more use of cotton.

Almost all *p*-xylene is converted to dimethyl terephthalate (DMT) or into purified terephthalic acid (PTA). DMT and PTA are made into polyester fibers and film, polyethylene terephthalate for bottles, or polybutene terephthalate for engineering plastics. The strong growth in bottle resins stopped in 1989 when prices were increased and the resins failed to capture markets for smaller sized bottles. As pricing settles out, the growth in bottle resins will continue to exceed growth for fibers. Exports, long expected to decline, are holding up, causing continuing pressure on capacity. □

Since '85 Chemistry Has Lost Ground In Race for Federal R&D Funds

However, academic chemistry held its own in 1980–88, growing 5.0% yearly in real terms compared with 3.7% for all federal academic support

Janice R. Long, C&EN Washington

Some questions: How well has academic chemical research fared since 1980? Is it getting more or less federal support than it was then? Has chemistry fared as well as other disciplines when it comes to obtaining federal research monies?

Some answers: The federal government spent about $4.1 billion on academic R&D activities in fiscal 1980. By fiscal 1988 that number had grown to $8.2 billion. Those figures represent an average annual growth rate of 9.1%. During the same period, federal funding of academic chemical research activities had grown from just under $190 million to over $400 million, an average annual growth rate of 9.8%. However, since 1985 increases for chemistry have not kept up with those experienced by other fields of research.

Those answers are found in a new report, "Federal Funding of Academic Chemistry Research FY 1980–FY 1988," published by the American Chemical Society's department of government relations and science policy. The report was prepared, at the request of ACS president Paul G. Gassman, by former ACS science policy fellow Patricia A. Cunniff, professor of chemistry and associate director of the science and technology center at Prince George's Community College, Largo, Md.

Chemistry accounted for 4.6% of total federal academic R&D funding in fiscal 1980. That share rose to a high of 5.2% in fiscal years 1984 and 1985 and then fell back to 4.9% in fiscal 1988. Physics' share of the federal pie in 1980 was 6.8%, hitting a high of 7.6% in 1986, and falling back to 7.0% in 1988. During the eight fiscal years covered in the report, federal funding for academic R&D in the area of life sciences never fell below 51% of the total and never rose above 53%, while engineering funding hovered between 14.5 and 15% of the total.

The picture is bleaker for basic academic research in chemistry. The real average annual increase in federal obligations for basic, academic chemistry research between fiscal 1980 and 1988 was 3.5%; the increase for all disciplines was 4.9%. And funding for basic chemical research actually declined 0.1% annually in real terms between fiscal 1985 and 1988.

Some ground rules must be observed in interpreting the report. One is that it adheres to the federal government's definition of chemistry. To wit, chemistry is a physical science that includes inorganic, organometallic, organic, and physical chemistry. As a consequence of this definition, the figures for chemistry quoted in the report do not include funding for such fields as biochemistry or geochemistry. They also do not include funding for chemical engineering R&D.

Second, R&D as reported on the federal surveys on which most of the report is based includes all research activities, both basic and applied, and all development activities supported at colleges and universities. R&D also includes such research equipment as computers, software, and spectrophotometers.

The report finds that, as a discipline within the university system, chemistry is more dependent upon federal monies than the life sciences and engineering but less dependent than physics. In 1988, academic chemistry received 71.2% of its R&D funding from federal sources, compared with the life sciences' 59.6%, engineering's 58.8%, and physics' 79%. Chemical engineering R&D is

Growth in federal support for academic chemistry R&D lags that for all R&D

										Annual change	
$ Millions, constant 1988	1988	1987	1986	1985	1984	1983	1982	1981	1980	1985–88	1980–85
Life sciences	$4311.1	3940.2	3708.4	3477.1	3182.3	3021.5	3047.2	3089.2	3007.6	7.4%	2.4%
Engineering	1224.6	1140.8	1036.2	944.8	877.5	863.7	849.1	865.0	856.5	9.0	2.0
Physics	573.3	543.6	540.6	493.3	437.4	399.9	373.0	403.3	402.1	5.1	4.2
Chemistry	403.0	376.0	358.8	341.4	314.2	289.2	280.5	283.0	272.4	5.7	4.6
Other[a]	1652.8	1544.3	1475.4	1353.1	1283.0	1241.6	1231.5	1313.5	1342.2	6.9	0.8%
TOTAL	$8164.8	$7544.9	$7119.4	$6609.7	$6094.4	$5815.9	$5781.3	$5954.0	$5880.8	7.5%	2.1%

Note: Fiscal years. a Includes mathematical, computer, environmental, and social sciences.

Chemistry proposals stand better chance getting NIH funding . . .

	Number of grant applications			Success rate
	Requested	Recommended	Awarded	
1980	699	618	295	41.8%
1981	745	678	274	36.8
1982	941	859	333	35.1
1983	730	693	275	37.5
1984	650	613	240	36.8
1985	803	766	353	43.2
1986	755	726	329	43.5
1987	645	621	259	40.0
1988	780	762	291	37.2

. . . than funding from NSF's chemistry division . . .

	Mean award size*		Mean duration in years	Success rate
	$ Current	$ Constant		
1980	$62,417	$89,662	2.4	30.4%
1981	68,619	89,616	2.4	41.0
1982	71,216	86,691	2.4	40.8
1983	75,686	88,394	2.6	40.8
1984	79,720	89,701	2.5	35.3
1985	84,261	91,971	2.7	35.9
1986	86,268	91,651	2.7	35.4
1987	86,173	88,715	2.5	30.2
1988	86,340	86,340	2.5	26.6
1989	84,590	81,477	2.5	34.0

. . . or from Air Force's Office of Scientific Research

$ Millions	Contract budget	Share to chemistry departments	Proposals received	Proposals funded	Success rate
1980	$ 6.3	$ 4.7	263	36	13.7%
1981	6.5	4.9	272	43	15.8
1982	7.6	5.7	322	74	23.0
1983	8.1	6.1	336	64	19.0
1984	8.3	6.2	371	69	18.6
1985	13.9	10.4	320	57	17.8
1986	13.8	10.4	331	23	6.9
1987	13.6	10.2	294	10	3.4
1988	16.0	12.0	289	14	4.8

Note: All years are fiscal years beginning Oct. 1. a Includes all awards between $2000 and $1 million by chemistry division. **Source:** American Chemical Society, "Federal Funding of Academic Chemistry Research FY1980–FY1988"

least dependent, getting only 51.3% of its support from federal sources.

As to which parts of the government fund academic chemistry, the answer is no surprise. Four federal agencies—the National Science Foundation, the National Institutes of Health, the Department of Defense, and the Department of Energy—provided over 92% of federal monies obligated to universities and colleges for chemical R&D in fiscal 1988.

NSF led the list, providing $111.6 million, or 37% of academic chemistry funding in 1988, over 96% of which went for basic research. Of that total, the chemistry division supplied $93.7 million and the division of materials research $22.47 million.

However, the omens are not good. The report points out that in constant dollars, NSF funding for academic chemistry grew at an average annual rate of 5.1% between fiscal 1980 and 1985. It then fell 1.8% per year between fiscal 1985 and 1988.

This trend is reflected in the chemistry division's budget, which rose steadily throughout the first half of the 1980s but stagnated in the second half, actually declining when corrected for inflation. The number of grants awarded by the division did rise from over 700 new and competing grants in fiscal 1980 to 1048 in fiscal 1988. However, the average annual grant size decreased nearly 10% in real terms during that period.

According to the report, the overall success rate for proposals submitted to NSF's chemistry division started the 1980s at 30.4%, hit a low of 26.6% in 1988, and climbed back to 34.0% in 1989. The success rate for NSF as a whole declined from 41.8% in 1980 to 37.2% in 1988.

Altogether, approximately 83% of the chemistry division's budget supports individual investigators. For NSF as a whole, individual investigator awards dropped from 68% of the research and related activities account in fiscal 1980 to 60% in fiscal 1988.

According to NSF surveys, NIH, primarily through the National Institute of General Medical Sciences, provided almost 30%, or $89.3 million, of federal funding for academic chemical research in fiscal 1988, up from a total of $74.4 million in fiscal 1986. NIH thinks it did a lot better than that. According to figures supplied for the report by the division of research grants special projects office, NIH awarded 1153 research grants worth $134.9 million to academic chemistry departments in fiscal 1986. In 1988, according to NIH, chemistry research grants (defined to include both chemistry and the structural chemistry of biopolymers) totaled $139 million.

According to the report, an NIH study for fiscal 1985 and 1986 found that the success rate for NIH grants submitted by chemistry departments was higher than the average for all departments. The chemistry department success rate for 1985 was 43.2%, compared with 37.2% for all departments, and 43.5% in 1986, compared with 35.8%. However, research grant support for chemistry is growing more slowly than is grant support overall.

DOD provided $41.3 million for academic chemical research in fiscal 1988, compared with $17.4 million in fiscal 1980. However, that 9.7% average annual rate of growth is most probably over for the near future. Army funding of academic chemical research has been declining steadily since 1986 and the rest of DOD is now treading the same downward path.

The fourth major funding agency, DOE, provided nearly $34 million for academic chemical research, both basic and applied, in fiscal 1988, compared with just under $15 million in fiscal 1980. In fact, at DOE the inflation-adjusted average annual growth rate for academic chemistry research during the period covered by the report, 5.8%, is higher than the 2.2% average annual growth rate in all academic disciplines funded by DOE. This occurred, the report notes, despite the fact that funding for the chemical sciences "grew at a constrained 2.9% per year in real terms" during the same period.

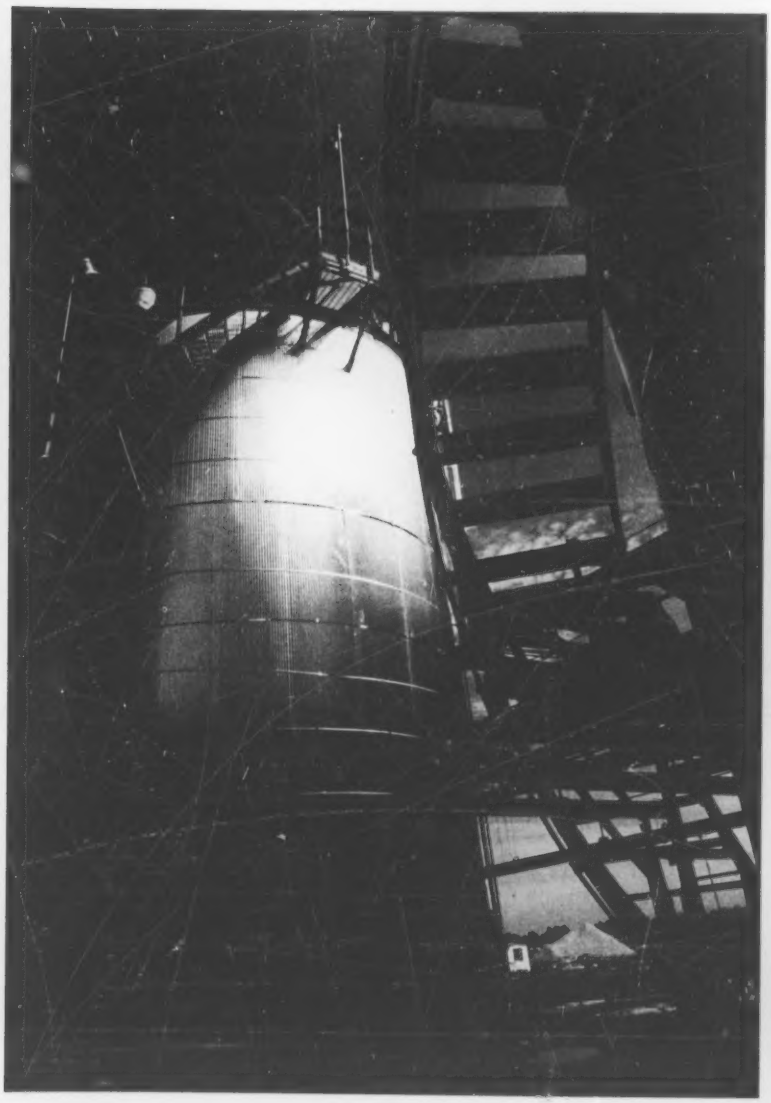
The ACS report concludes on a somber note saying that "While chemistry experienced growth between fiscal 1980 and 1988, based on analyses of both obligation data and expenditure data, the slowing down of this growth after 1985 warrants monitoring." □

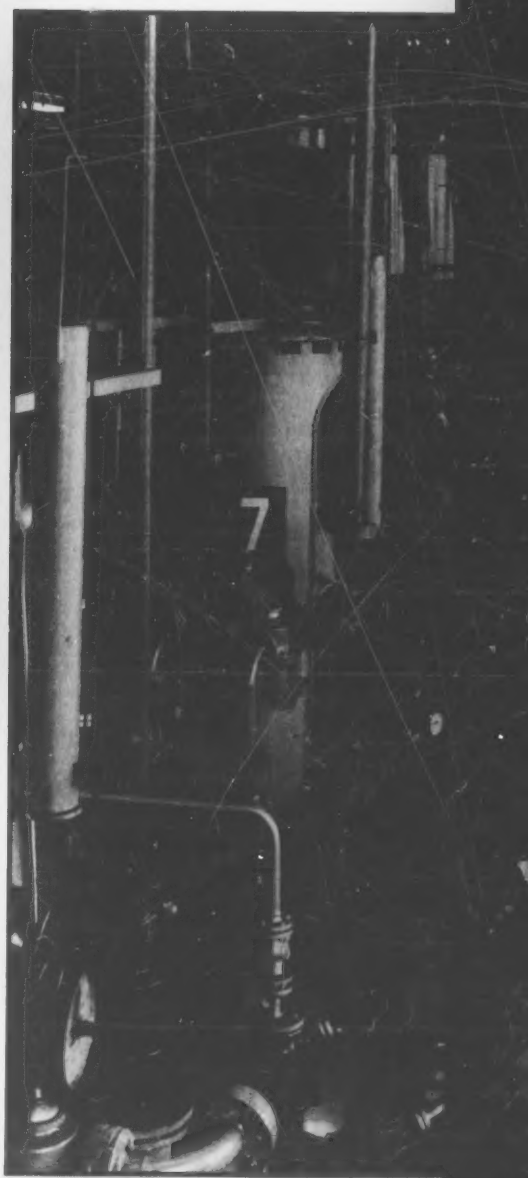
World Chemical Outlook

The recession that the majority of business analysts agree is now under way in North America—or at least will be by the start of 1991—may well be one of the best heralded downturns on record. But that will not make it any easier to weather for the chemical industry—especially if, as seems likely in an increasingly global economy, the slump spreads worldwide.

Already chemical producers worldwide are smarting under the shock of sharply higher costs for their key raw material, petroleum. If consumption of chemicals were high and growing, producers probably could pass the rise in their operating expenses through to their customers. In fact, they have been doing just that to some degree.

But as overall economic growth stalls, falling demand is severely limiting their ability to control prices. And it doesn't help that a number of big new petrochemical plants, planned during the period of heady growth during the late 1980s, now are coming on stream, adding potentially unneeded and possibly in-





digestible increments to available supplies.

The last time the chemical industry went through a cost/price wringer—in the early 1980s—it emerged much changed following a wave of reorganization and restructuring that was undertaken to pare costs and trim excess capacity. That effort seemed to pay off during the heated prosperity of the late 1980s, when chemical companies reaped bountiful profits. But the real effectiveness of their tightened operations will be put to a much more telling test during the chillier economic climate now in prospect.

United States 26

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Costs up, demand slack: pain for chemical firms

With consumption curtailed in several key markets, U.S. chemical industry is finding profitability under pressure

David M. Kiefer
C&EN Washington

With demand depressed in several key markets, consumption of chemicals is easing. Consequently, output of chemicals also is slowing—just as several big new plants have come, or are about to come, on stream. At the same time, turmoil and tension in the Middle East have triggered a sharp surge in the cost of crude oil, one of the chemical industry's most important raw materials.

Clearly, then, U.S. chemical producers are going to have to belt up for a rough ride for the next few months, if not longer. While sluggish demand is putting a lid on selling prices, rising costs will be eroding profits.

Recent statistics give only a hint of potential problems, to be sure. Production of chemicals and synthetic materials has edged moderately lower since its recent peak last spring; now it's probably running about 1% below the level of late last year. And it probably would be off even further were it not for customers' distorting demand during the past few months by building up their inventories in anticipation of higher prices. For all of 1990, output will be essentially unchanged from 1989, after being ahead by nearly 1% during this year's first half.

Output for the chemical industry as a whole, meanwhile, has slipped to about 81% of capacity, according to Federal Reserve Board data. That's down from a peak of 87% in 1988. Even so, capacity utilization is still comfortably higher now than eight years ago, when it fell as low as 70%.

Selling prices of chemicals by last summer had been drifting downward for more than a year. They were under pressure from sluggish growth in the overall U.S. economy and customers' hesitancy to place orders pending the expected startup of big increments in plant capacity. Polyethylene capacity in North America, for example, will be nearly 20% higher than now by the end of 1991.

Since August, however, chemical prices have ballooned—more than 5% since a year ago, on average, for industrial chemicals—as oil prices doubled and producers tried to pass on to their customers, as much as possible, the sudden rise in the cost of their hydrocarbon feedstocks, natural gas as well as petroleum, on the heels of the military crisis in the Persian Gulf. Nevertheless, the current rise in selling prices has only partially offset higher raw material expenses. For all of 1990, though, prices of industrial chemicals will average about 1% less than last year.

The result has been a sharp fall in the earnings of basic chemical producers. Net income for companies making industrial chemicals and synthetic materials was down about 25% from the year before during the first nine months of 1990. This year's fourth quarter will not stack up quite that unfavorably with 1989's like quarter, but only because profits already were deeply depressed then. For all of 1990, though, the industry probably will turn in earnings about 20% under those of the year before.

Next year, with the nation's economic climate expected to be much more chilly than during the past few years, the chemical industry may find itself put to the test. Much depends, of course, on just how stressful business conditions actually are in the next few months. Clearly, growth has slowed markedly in the overall U.S. economy. Nevertheless, government statistics still do not offer conclusive evidence that the unprecedentedly long (in peacetime) expansion of the past eight years has finally ended. Gross national product (after factoring out inflation) continued to grow—at a better-than-anticipated annual rate of 1.7%—during 1990's third quarter. That's up from an anemic 0.4% rate in the second quarter and was about on par with growth in the first quarter.

Economists, as usual, are not speaking with one voice in assessing the current business scene. But the consensus among forecasts now points strongly to a recession in U.S. business by the beginning of next year—if it is not now already here.

Most economists also are predicting that the impending recession will be relatively shallow and short-lived—lasting, most likely, no more than six to nine months and pulling real GNP down less than 2%.

By next autumn, then, if such predictions are on the mark (and assuming the shock of the Mideast crisis has eased), business will be once more on the upswing. That would make the 1991 recession one of the least painful on record—certainly much less so, for example, than the most recent previous recession in 1981 and 1982.

But it is not hard to find dissenters to this consensus view. On one end of the scale are a declining number of optimists who continue to argue that even though economic growth is lagging, the slowdown will not fall into actual recession. On the other end are numerous pessimists who contend that the nation's economic structure is much more rickety than is generally recognized.

They warn that the country should gird itself for a long, severe decline, one akin to the 16-month slump of 1981–82, which was probably the worst the U.S. has suffered through since the 1930s. And they buttress their concern by pointing to the present heavy burden of outstanding public and private debt, the intractable federal budget deficit, the financial fragility of the U.S. banking system, tight credit in the wake of the savings-and-loan scandals, and the economic cost and inflationary consequences of high and volatile energy prices. All these factors might well make recovery uncertain, if not unlikely, any time before the end of 1991, if even then.

Whatever the prognosis for the economy as a whole, it is certain that several of the chemical industry's most vital markets—notably construction and motor vehicle manufacturing—are already in distinct decline.

Probably no sector of the economy has been in more serious trouble than homebuilding. The number of new housing starts has been declining each month since last January; by October it had hit the lowest level, at an annual rate of only a little over 1 million, for any month in more than eight years. Only about 1.2 million housing units are likely to be started in all of 1990, 13% fewer than the year before and down a third from four years ago.

About the only good news in the housing business is that it seems unlikely that it can sink much lower. Next year, housing starts are generally expected to fall a bit more, to be sure, dropping to somewhere between 1.0 and 1.1 million. But most analysts think that will be the bottom and that homebuilding really has nowhere to go but up. Housing starts have not been lower than 1 million, after all, in over 30 years.

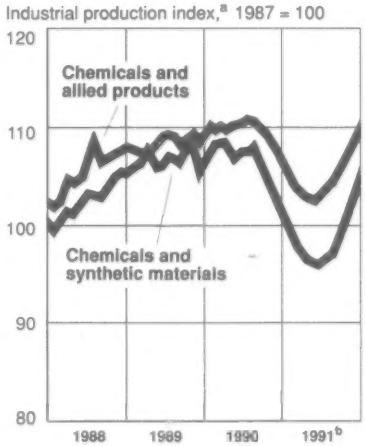
But if housing looks bad, commercial construction—stores and office building, for example—is much the worse. Office vacancy rates are high—near 20%—nationwide and retail merchants have been plagued by overexpansion. As a result, the value of commercial building contracts likely will plummet 8 to 10% this year and fall at least half as far again in 1991.

The automobile industry likewise has been a weakening market for chemical products. Lower total car and truck sales in the U.S. this year are forcing cutbacks in car production as well. Output of new cars will probably drop at least 10 to 11% below the 1989 total, while truck production is likely to drop 5%. And next year is likely to bring further declines, with total vehicle output off as much as 10%.

Other consumer products that are important markets for chemicals are hurting, as well. Analysts expect shipments of all electrical appliances to ease 3 to 5% this year and proba-

Slackening demand is trimming chemical output . . .

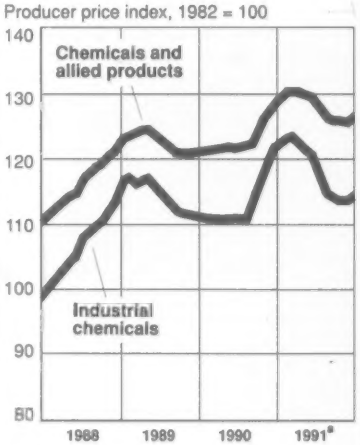
Industrial production index,[a] 1987 = 100



a Seasonally adjusted. b C&EN estimates.
Source: Federal Reserve Board

. . . and after a brief uptick, prices will soften . . .

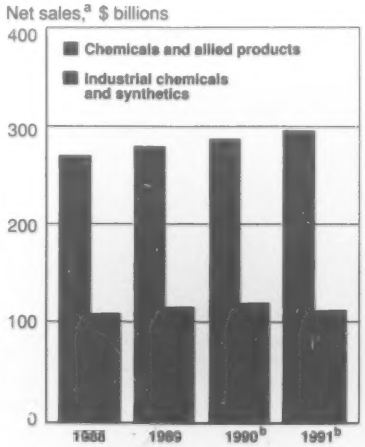
Producer price index, 1982 = 100



a C&EN estimates.
Source: Bureau of Labor Statistics

. . . crimping chemical producers' sales . . .

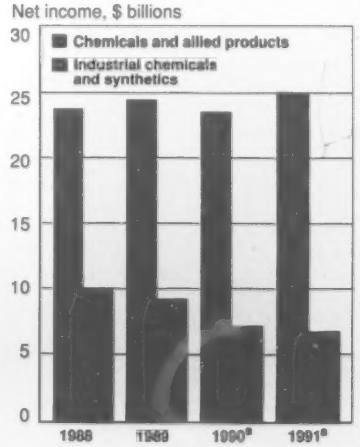
Net sales,[a] $ billions



a Excludes sales of foreign affiliates. b C&EN estimates.
Source: Bureau of the Census

. . . and putting severe pressure on profits

Net income, $ billions



a C&EN estimates.
Source: Bureau of the Census

bly show a similar drop next year. Meanwhile, textile production has been, at best, stagnant and probably will decline 2 to 3% in 1991. Production of furniture is in similar straits.

All of which probably spells big trouble for producers of big-volume chemicals, plastics, and man-made fibers during the next few months. The excessive inventory hedging of the past few months will rob sales from the first half of 1991. For the year as a whole, weaker demand is likely to cut production 7 to 8% below 1990's level. Looking across the economic valley (assuming it is indeed a shallow one), output of industrial chemicals and synthetic materials will be no higher by year end 1991 than it was a year ago; capacity utilization will be appreciably lower.

One positive factor for U.S. chemical firms recently has been their foreign trade. With the U.S. dollar depressed relative to currencies in the industry's major overseas markets in Europe and the Far East, U.S.-produced chemicals have been very cost competitive. In addition, U.S. producers of petrochemicals are less affected by higher oil prices because for feedstocks they (and their Canadian counterparts) rely more on ethane and propane from natural gas and less on petroleum-derived naphtha than their European and Japanese competitors. North America thus can make petrochemicals and many plastics more cheaply than just about anywhere else.

But economic growth, which this year has generally been more buoyant in many places abroad than in the U.S., is expected to slacken in Europe and Japan as well in 1991. In several overseas markets, too, local production is displacing imported materials. Consequently, U.S. exports of chemicals, up a mere 4% this year, may not grow at all in 1991.

In this business climate, makers of commodity chemicals and plastics will be hard pressed to hold their recent price levels. By next spring, selling prices of industrial chemicals and plastics are likely to be declining again, although prices for 1991 as a whole probably will average 4 to 5% higher than this year. That will be nowhere enough, though, to offset higher raw material costs.

As a result, profits for producers of basic chemicals probably will take another hit next year. The drop, year-to-year, though, is not likely to be quite so severe as this year.

The broad chemicals and allied products industry includes, of course, many firms that do not market commodity chemicals or plastics. Among these are a diverse assortment of specialty chemical makers, and for them the outlook is markedly brighter. Their raw material costs are tied much less directly to hydrocarbon prices and their selling prices are less at the mercy of classic supply-and-demand constraints. Many of them, too, service relatively recessionproof noncyclical customers.

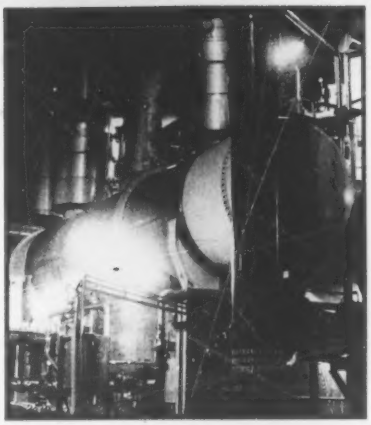
Even more of a special case is that major segment of the industry that produces pharmaceuticals. Its relatively recessionproof sales, bolstered by introduction of a stream of new and profitable medicines, are likely to rise 10 to 15% this year and do at least as well again in 1991. Profits, moreover, will at least match that pace both this year and next.

These specialty areas of strength will keep sales of the broad chemicals and allied products industry on the uptick during the year ahead. And though profits for the overall industry can be expected to sag about 5% in 1990, they are likely to recover all that loss in 1991. □

Production of most major chemical products is heading lower

	1988	1989	1990	1991
INORGANIC CHEMICALS				
Thousands of tons unless otherwise indicated				
Ammonia	16,821	16,362	16,450	16,700
Chlorine gas	11,257	11,161	10,800	10,400
Hydrochloric acid	2,640	2,628	2,300	2,150
Nitric acid	7,991	8,349	7,700	7,900
Oxygen, billions of cu ft	452	452	460	450
Phosphoric acid	11,659	11,737	12,100	12,350
Sodium hydroxide	10,527	11,075	11,750	11,350
Sulfuric acid	42,580	43,301	44,300	45,000
ORGANIC CHEMICALS				
Millions of lb unless otherwise indicated				
Acetic acid	3,159	3,537	3,500	3,300
Acetone	2,303	2,497	2,500	2,300
Acrylonitrile	2,609	2,355	2,700	2,500
Benzene,[a] millions of gal	1,608	1,585	1,600	1,400
Butadiene	3,169	3,094	3,000	2,700
Caprolactam	1,261	1,312	1,300	1,250
Cumene	4,455	4,535	4,150	4,000
Cyclohexane	2,297	2,389	2,300	2,100
Ethylene	37,204	34,953	36,000	34,500
Ethylene glycol	5,517	5,499	4,550	4,200
Formaldehyde	6,280	6,374	6,250	5,800
Methanol	8,142	7,139	7,700	7,200
Phenol	3,562	3,892	4,150	3,800
Phthalic anhydride	999	1,102	950	900
Propylene	21,224	20,027	21,500	20,400
Styrene	8,984	8,129	7,900	7,400
***o*-Xylene**	971	842	875	800
***p*-Xylene**	5,601	5,494	5,200	5,000
PLASTICS				
Millions of lb				
Polyethylene, high density	8,400	8,102	8,100	7,800
Polyethylene, low density	10,397	9,695	10,800	10,300
Polypropylene	7,274	7,238	8,000	7,600
Polystyrene	5,187	5,104	5,000	4,600
Polyvinyl chloride	8,350	8,478	8,900	8,500
SYNTHETIC FIBERS				
Millions of lb				
Acrylic and modacrylic	588	543	510	450
Nylon	2,669	2,740	2,700	2,400
Olefin and vinyon	1,588	1,639	1,850	1,800
Polyester	3,681	3,594	3,150	2,900

a Petroleum refiners only. **Sources:** Bureau of the Census, International Trade Commission, Society of the Plastics Industry's Committee on Resin Statistics, Fiber Economics Bureau, C&EN estimates (for 1990 and 1991)



Chemical industry awaits trade talk results

Even lackluster export performance seems less important than outcome of GATT negotiations

Earl V. Anderson
C&EN Northeast News Bureau

The chemical industry's foreign trade experts have set aside their statistics, at least for the time being. Those statistics are not all that spectacular this year, in any event. Their eyes, however, have been more focused in recent months first on Geneva and then, more recently, on Brussels.

In Geneva, negotiators at the massive Uruguay round of multilateral trade talks have been working to put the finishing touches on four long and arduous years of negotiations. The talks, the most ambitious ever by the General Agreement on Tariffs & Trade (GATT), encompass foreign trade in agriculture and services, as well as investment rules and, as usual, tariffs and nontariff barriers.

But even after four years, negotiators in the 15 individual committees have been unable to agree on many key issues. So as they packed their bags late last month to leave Geneva, agreement on many important issues seemed out of reach.

The focus switched to Brussels last week, the deadline set for completing the Uruguay round. There, ministerial-level representatives of the nearly 100 countries taking part in the trade talks met to put their stamp of approval on the agreements worked out by exhausted negotiators in Geneva.

At C&EN's press time, there was precious little to stamp. What the trade ministers found in Brussels were committee reports, some with pages blank and others cluttered with "bracketed text"; the brackets indicate wording that had not yet been agreed upon. Only if the trade ministers are able to make some very tough political decisions will the Uruguay round stand a chance of being salvaged.

The make-or-break issue in the Uruguay round is agriculture. The farm issue pits the U.S. and the so-called Cairns group of 14 countries that are major agricultural exporters against the European Community.

The U.S. and the Cairns group want deep cuts in domestic farm supports and export subsidies. The EC, where farmers are heavily subsidized and carry a lot of political clout, has offered much less—so much less that the Cairns nations have threatened to walk out of the Uruguay round unless the EC vastly improves its offers.

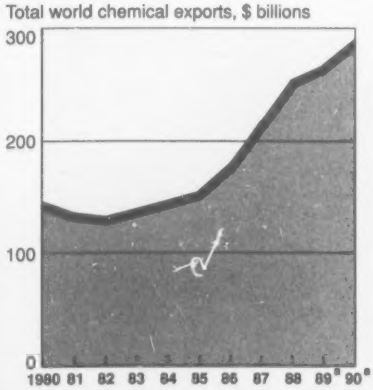
But agriculture is not the only sensitive—and unresolved—Uruguay round issue. Trade in such services as banking, insurance, and engineering is probably the most complicated. And many concerns regarding protection of intellectual property remain unresolved.

Rules covering foreign investment, one of several matters new to GATT, also still are not completely resolved. Basically, developing nations want foreign investment tied to performance requirements, such as mandatory export volumes and the use of domestic raw materials. Industrialized nations want foreign investment unfettered.

Globally oriented U.S. chemical companies are concerned about

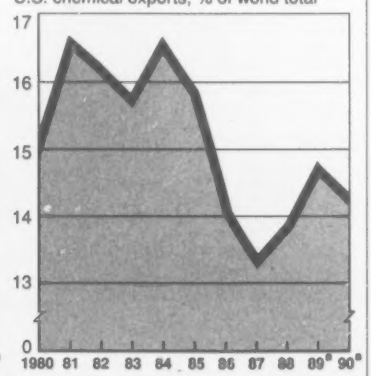
World chemical exports show solid growth . . .

Total world chemical exports, $ billions



. . . while U.S. industry's share declines slightly

U.S. chemical exports, % of world total[b]



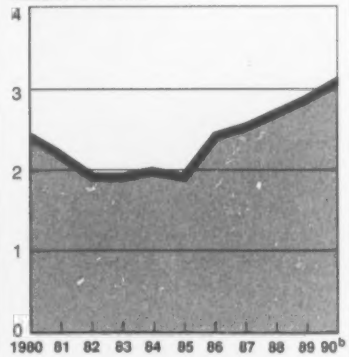
a C&EN estimates. b Defined as U.S. chemical exports as percentage of world chemical exports less U.S. chemical imports.
Sources: United Nations, Organization for Economic Cooperation & Development, European Community, Japanese Ministry of International Trade & Industry

Plastics and pharmaceuticals spur growth in U.S. chemical exports

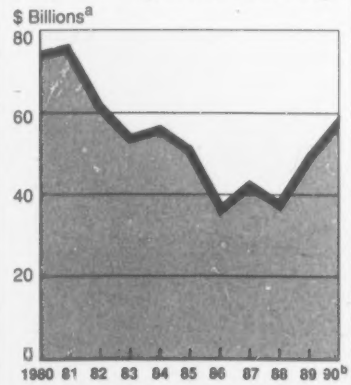
$ Millions	U.S. chemical exports				U.S. chemical imports			
	1990[a]	1989	1988	1987	1990[a]	1989	1988	1987
Organic chemicals	$10,032	$10,609	$ 9,381	$ 7,550	$ 7,298	$ 7,042	$ 6,953	$ 5,408
Plastics and resins	8,740	7,928	7,277	5,492	3,805	3,316	2,433	1,987
Medicinals and pharmaceuticals	4,028	3,660	3,941	3,182	2,403	2,086	1,859	1,456
Inorganic chemicals	2,660	2,986	2,702	2,122	2,158	2,239	2,498	2,030
Fertilizers, manufactured	2,470	2,821	2,498	2,259	935	999	1,021	795
Flavors, perfumes, cosmetics, and toiletries	1,330	1,053	709	579	1,090	968	932	796
Pigments, paints, and varnishes	1,178	772	449	411	579	515	395	427
Radioactive materials	1,102	1,333	868	1,017	979	992	1,098	1,012
Cleaning and polishing materials	608	416	395	357	245	197	260	205
Dyeing, tanning, and coloring materials	418	325	258	217	712	618	610	621
Explosives and pyrotechnics	152	123	91	91	156	131	118	110
Miscellaneous	5,282	4,459	3,731	3,114	1,890	1,649	1,699	1,366
TOTAL	$38,000	$36,485	$32,300	$26,381	$22,250	$20,752	$19,876	$16,213

a C&EN estimates. Source: Bureau of the Census

U.S. oil imports: higher volume this year . . .



. . . and much higher prices send oil import bill soaring



a All petroleum products. b C&EN estimates.
Source: Bureau of the Census

many of these issues. But by far the most important for them is market access. "Market access" refers to the linkage between negotiations on tariffs and nontariff barriers (or measures, as they now are called). From the outset, chemical industry representatives have been telling U.S. trade officials that they don't want to see the Uruguay round degenerate into a simple tariff-cutting exercise. If tariffs are to be reduced, the U.S. chemical industry also wants negotiators to dismantle many of the nontariff barriers that keep its exports out of foreign markets.

"Market access is nowhere near finished," said Max L. Turnipseed as the trade ministers were preparing to assemble in Brussels. Chemical industry advisers worked feverishly with U.S. officials to prepare a final document on market access before the meeting. But Turnipseed, who is Ethyl Corp.'s manager of international trade, wasn't optimistic.

The EC had made a late offer to eliminate tariffs on some petrochemicals and plastics and to harmonize others at "mid-range" tariff rates. But its offer hinged on other petrochemical-producing countries agreeing to do the same.

The U.S. and the EC were not too far apart, says Turnipseed. But some of the newly industrialized countries, such as Taiwan and South Korea, as well as Mexico and Brazil, would have no part of the deal. "I think it's dead," says Turnipseed.

Several reasonable offers have been made on chemical tariff cuts, with the U.S. offer "more reasonable," in the view of the U.S. industry than the others. But without movement on nontariff barriers, the U.S. chemical industry wants U.S. trade officials to walk away from the table. It would rather see no deal at all than what it considers a bad deal.

Administration officials claim that they feel the same way. But there's no guarantee that their definition and the industry's definition of good and bad are the same. Even if high-level trade ministers were to agree in principle on a market access package in Brussels, it would take well into January to work out the details. And right now, time is not on the side of the negotiators.

The Uruguay round was scheduled to end three days ago. U.S. trade officials have been reluctant to extend negotiations beyond then, although they may do so if "enough political will" surfaces at Brussels.

Still, a market access package will have to be completed by mid-January if the Bush Administration is to have enough time to prepare the results for Congress. Legislators must give these results "fast-track" treatment when they get them. This means that they have to vote up or down on the package, without amendments.

But to get this fast-track attention, the Administration must have its Uruguay round agreements on Cap-

itol Hill by March 1. It is a deadline they can hardly afford to miss, because already many members of Congress are pushing to do away with the fast-track approach.

By now, the trade ministers who met in Brussels last week may or may not have resolved some of the many contentious issues that plagued the Uruguay round. One thing is certain, however. Whatever decisions come out of the Brussels meetings will have a major impact on chemical trade worldwide.

But Uruguay round or no, chemical trade goes on. Unfortunately for the U.S. chemical industry, it isn't going on so spectacularly this year as it has in recent years.

U.S. chemical exports probably will hit $38 billion this year. That's a lofty figure, but only 4% higher than last year's $36.5 billion. Coupled with a 7% jump in U.S. chemical imports, the small advance in exports keeps the country's surplus in chemical trade at $15.7 billion, just about the same as last year. This relatively low growth in chemical exports is surprising, because the U.S. dollar has been weakening all year. As of late last month, it had lost 15% of its value against the German mark and 11% against the Japanese yen since the end of 1989.

Theoretically, a weak currency helps exports by making them less expensive on world markets than products produced in strong-currency countries. But in practice, exports often defy theory.

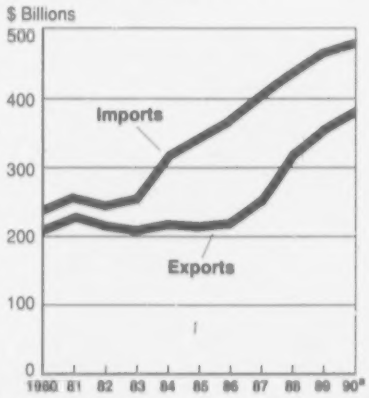
One possible explanation is that world prices for crude oil are set in dollars. As a result, countries with strong currencies can buy more dollars and hence get more oil for their money. Many overseas producers of petrochemicals use oil-based naphtha as their feedstock. As a result, they are benefiting from the weak dollar on the raw materials end at the same time that U.S. exporters are benefiting in the marketplace. The net result: something of a standoff.

A more mundane reason for the slow growth in chemical exports is that some overseas markets are starting to satisfy their own demand with local production. Exports of organic chemicals, the largest single category of U.S. chemical exports, is off more than 5% this year from last year. Most of that drop is a result of weaker markets in Asia, where several countries have increased their own petrochemical output.

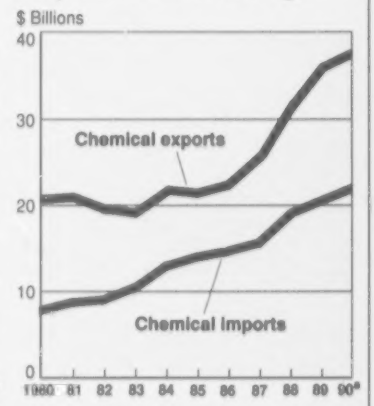
This year's chemical exports from the U.S may be even worse than they seem. The Census Bureau is revising last year's statistics on exports to Canada. These adjustments may show that last year's chemical export total for the U.S. actually was $38 billion, instead of $36.5 billion. If so, this year's chemical exports will have shown no growth compared with last year. And this year's chemical trade surplus will be $1.5 billion less than last year.

But chemical industry trade experts won't have much time to analyze trade statistics. Not only will they have to contend with the aftermath of the Uruguay round, they also will have to start concentrating on the potential impact on their business of the upcoming free trade talks between the U.S. and Mexico. □

U.S. trade deficit shrinks some more . . .



. . . as chemical trade surplus remains strong



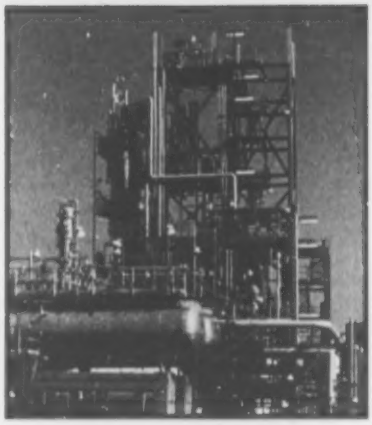
a C&EN estimates. **Source:** Bureau of the Census

Strong manufactured goods exports cut U.S. trade deficit despite higher oil imports

$ Billions	U.S. exports 1990a	1989	1988	1987	U.S. imports 1990a	1989	1988	1987
Chemicals	$ 38.0	$ 36.5	$ 32.3	$ 26.4	$ 22.3	$ 20.8	$ 19.9	$ 16.2
Machinery and transportation equipment	171.0	148.8	135.1	108.6	204.4	205.6	197.0	177.8
Other manufactured goods	69.9	59.8	47.3	36.5	141.3	138.5	131.9	118.6
Crude materials (inedible) other than fuels	27.0	26.9	25.1	20.4	14.7	15.4	13.4	11.5
Mineral fuels, lubricants, and related materials	10.8	9.9	8.2	7.7	59.9	52.5	41.1	44.2
Food and live animals	29.3	29.7	26.4	19.2	22.2	20.6	20.1	20.5
Beverages and tobacco	6.2	5.5	4.5	3.7	4.4	4.4	4.1	4.1
Animal and vegetable oils and fats	1.1	1.4	1.	1.0	0.8	0.7	0.8	0.6
All other products	14.3	31.2	27.5	20.4	17.0	14.4	12.6	12.4
TOTAL	**$386.0b**	**$364.3b**	**$322.4b**	**$252.9b**	**$487.0**	**$472.9**	**$440.9**	**$405.9**

a C&EN estimates. b Includes reexported imports (not included in individual product categories). **Source:** Bureau of the Census

Western Europe



Feedstock costs hurt firms' profits

Fallout from Mideast, softening economies overshadow rebuilding in East Europe

Patricia L. Layman
C&EN London

For the chemical industry of Western Europe, this clearly has been the year of Eastern Europe—although developments there were being overshadowed during the second half of the year by the Middle East crisis, which sent costs of oil-based feedstocks soaring and twisted profit margins.

Moreover, these factors—efforts to rebuild the chemical industry in the old East Bloc and the struggle to cope with a volatile and distorted feedstock price base—will continue to dominate the Western European chemical industry in 1991.

December brings down the curtain on an extraordinary year. Business was fair during the first six months, if not exactly earning plaudits. Even so, the unusually high profit margins companies had enjoyed during the two previous years, which were due in part to high demand that had overstretched capacity, were settling down to more sustainable levels. Although raw material costs were rising slowly, companies were finding some difficulty in passing along higher prices, as customers awaited increases in product availability as new capacity came on stream. But the balance was one the chemical industry could live with, albeit with grumbles.

Iraq's Aug. 2 invasion of Kuwait, however, sent feedstock costs soaring. Naphtha, the major feedstock for Western European ethylene crackers, zoomed from $157 per metric ton average in July to $300 per metric ton by late August; since then, it has continued to increase, at one point topping $400 per metric ton.

According to Bryan Sanderson, chief executive officer of BP Chemicals in London, Western European chemical producers use about 60 million metric tons of naphtha equivalent a year, 80% of which goes into ethylene production. An increase in price of $100 per metric ton thus represents a cost increase to the industry of about $500 million per month.

The results were inevitable for petrochemical producers. As Jürgen Strube, chairman of Germany's BASF, put it late last month, "After crude oil and naphtha prices had doubled, we succeeded rather rapidly in putting in price increases for basic petrochemical derivatives, particularly polyolefins—but they did not suffice to offset the rise in raw material costs. August and September earnings," he added with understatement, "were very unsatisfactory."

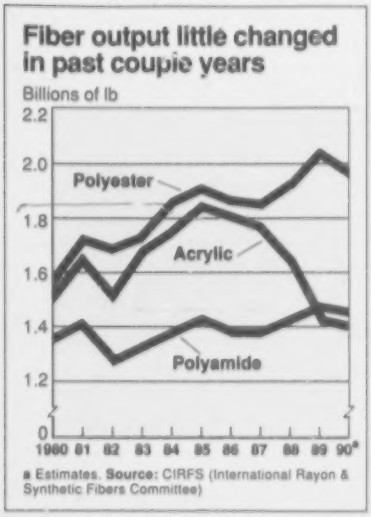
The decline in BASF's profits, compared with like periods of 1989, is mirrored by those of other major European chemical producers, such as fellow German giants Hoechst and Bayer; Britain's ICI, BP Chemicals, and Shell; the Netherlands' Akzo and DSM; and France's Rhône-Poulenc. Because earnings were at record levels in 1988 and 1989, it is no surprise for there to be a drop in profit levels this year—although it probably would not have been as steep or dramatic were it not for the Middle East crisis.

The only companies that have been reporting earnings increases for the year are those whose operations are far enough downstream from basic chemicals—for example, in consumer product areas such as pharmaceuticals or in specialty chemical markets—to escape the direct brunt of petrochemical price effects.

On the other hand, even these Western European companies have all been hit by adverse currency exchange rates, particularly that of the U.S. dollar, which weakened significantly after the invasion of Kuwait. Profits transferred by such companies from the U.S., for example, or from such other dollar-important areas as Japan and elsewhere in the Far East, can trim sizable amounts from a company's net income. The other side of the coin, of course, is that when the European subsidiaries of U.S. chemical firms transfer their profits from strong European currencies into weaker dollars, reported earnings improve significantly.

Chemical companies are beginning to have some success in passing rising feedstock costs along to their customers. It seems clear, nonetheless, that 1990 will be at best no more than a fair-to-middling year for chemical company earnings.

Coupled with a decline in profits, production for the West European industry as a whole has also dropped off compared with 1989. Late last year, chemical industry executives were optimistically forecasting that production in 1989 would be up 3.5 to 4% over 1988, and that 1990 would continue that growth pattern very closely. There was little likelihood, executives believed then, of a decrease in production, let alone a recession.



By the middle of 1990, however, signs of slowdown were becoming clear. CEFIC, the European Chemical Industry Federation, predicted in its annual report issued in June that chemical output growth would slow to about 2.5% in 1990, a growth rate that would be lower than that for all manufacturing. The final figure for full-year 1990 undoubtedly will be significantly lower still.

For 1991, the catchwords seem to be "caution" and "uncertainty." Executives at Shell International Chemical in London note that although some degree of market stability is now emerging, the underlying trend remains uncertain and very sensitive to potential Middle East developments. Optimism for 1991 is overshadowed by a wait-and-see attitude. And Akzo officials predict that "a turnaround will probably not take place in the short term."

That assessment is echoed by Sir Denys H. Henderson, chairman of ICI. Speaking late last month before the Society of Business Economists, he said that there is "no doubt" that the U.K., as well as the U.S., Australia, and Canada, have been in recession for some time, and that there still is little evidence of any soft landing, fall in interest rates, or business recovery. His own prediction is that the current downturn will last for 12 to 18 months, with "little likelihood of a pickup until the second half of 1991 at the earliest." For a really solid economic recovery to proceed, he added, the Kuwait crisis must be resolved, oil prices must fall back to what he sees as a "real" level of $20 a barrel, and interest rates must fall worldwide.

One of the few "certainties" that remain for West Europe's chemical industry is the appeal of Eastern Europe.

Compared with such Western European industries as banking and telecommunications, which rushed into Eastern Europe—particularly into the former East Germany—to carve out business, the chemical industry has been taking its time in moving eastward. But its pace of activity also has begun picking up.

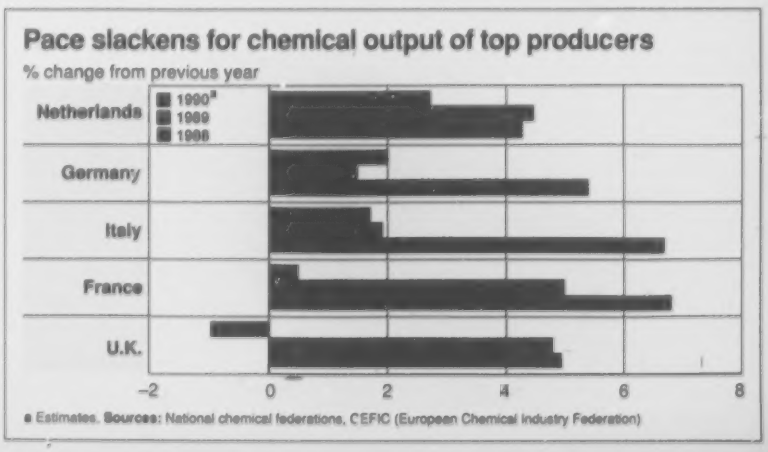
Chemical companies have been sending delegates to the plethora of conferences that are being held now on business opportunities and on the "hows-and-whys" of doing business in the East. They have been sending representatives to the Eastern countries to reconnoiter, meet people, and become acquainted with possible venture partners or acquisitions. And they have begun setting up sales offices there to begin to learn about customers, markets, and selling methods. And this groundwork is beginning to pay off: West European chemical firms are beginning to make strategic deals—joint ventures and partial acquisitions—in selected, specific areas of Eastern Europe.

As part of their preliminary work, companies are trying to pin down a variety of factors, including enabling legislation in the different countries, environmental conditions, and the condition of plants and equipment. There actually may be some pleasant surprises in Eastern Europe, says Alan Plaistowe, president of consultants Chem Systems International of London. "We are coming to the conclusion that the capital stock of the industry may not be as bad as everyone seems to think. Some of the more modern, larger plants and refineries have some chance of survival with selective modernization."

Chemical companies within western Germany are leading the way into the east, although firms elsewhere are getting the itch as well. A case in point is BASF, which recently acquired Synthesewerk Schwarzheide, which had been the only urethane maker in East Germany and was one of only a few urethane suppliers to the rest of the East bloc.

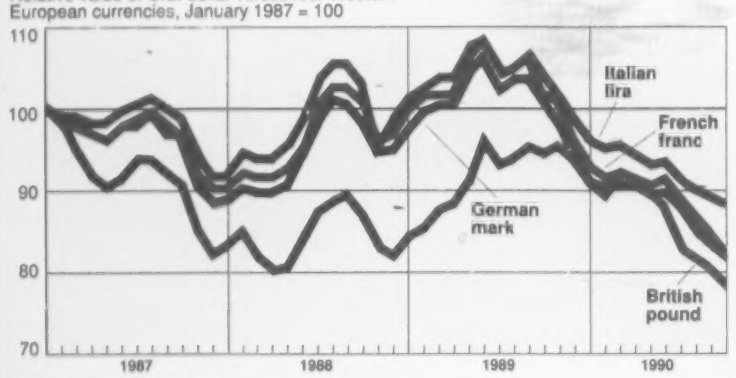
BASF took over Schwarzheide at the beginning of November, so its sales are not yet being consolidated with the Ludwigshafen parent. But according to one report, Schwarzheide is ultimately expected to contribute up to a quarter of BASF's sales of urethanes. BASF will not be held liable for Schwarzheide's previous chemical pollution. However, the company has already said it will put roughly $340 million into the former East German plant, much of it for environmental cleanup of plant and infrastructure, according to Strube.

Additionally, BASF has a cooperation agreement with animal feed-premix maker Dr. Ponsold GmbH of Saxony-Anhalt. BASF will give tech-



After strengthening in early 1989, dollar slumps this year

Relative value of U.S. dollar versus four Western European currencies, January 1987 = 100



Source: International Monetary Fund

nical and commercial help in meeting the West German laws and regulations on feed that now apply throughout Germany. Dr. Ponsold is the leading manufacturer of premixes in the five Eastern European states.

BASF's Wintershall energy subsidiary also has worked out an agreement with Gazprom, of the Soviet Union, for joint projects to produce, clean, and subsequently process natural gas for industry and homes. Gazprom probably is the world's largest producer, transporter, and exporter of natural gas, and this deal marks the first private direct equity participation by a Soviet enterprise in the West, according to BASF.

Hoechst is holding talks with Lacke und Farben of Berlin regarding cooperation in the areas of paints, lacquers, and resins for industrial applications. Hoechst is also negotiating to acquire some of the operations of Technische Gase Leipzig (TEGA Leipzig). To augment this, Hoechst plans to build a major air separation plant in eastern Germany.

Meanwhile, Air Liquide has already purchased a distribution network for cylindered industrial gases in eastern Germany and the industrial gas production and distribution sites of TEGA Berlin, as well as some operations of TEGA Leipzig. Air Liquide also plans to build a plant in the Leipzig area for producing oxygen, nitrogen, and argon.

Glaverbel, a Belgian flat-glass maker controlled by Japanese producer Asahi Glass, has made a major investment in SkloFlat, the state-owned Czech glass company. Glaverbel acquired 40% of SkloFlat for about $48 million. After three years, Glaverbel can increase its share to 65%.

French oil firm Elf Aquitaine, too, is holding discussions with Czech officials dealing with energy and chemicals. And Finnish producer Neste Chemicals has appointed representatives in Warsaw and Prague to market its products and sound out business opportunities, a job previously handled by Neste Chemicals' offices in Vienna.

Neste is already well along in talks with Czechoslovakia's CHZ Litvinov to market polyethylene plastics and carry out polyethylene product development. According to Jukka Viinanen, executive vice president at Neste Chemicals, "The discussions are going very well; it is obvious we will reach an agreement on polyethylene."

In a move to beef up its presence in Eastern Europe, the U.K.'s ICI is shaping its representative liaison offices in each East bloc country to become wholly owned subsidiaries, with the freedom to conduct their own business affairs.

And Akzo has already set up a coatings joint venture with TVK in Hungary, as well as formalized a cooperative agreement with Finowtal, a producer of carboxymethyl cellulose, in eastern Germany.

In part, just being there is one of the most significant commitments a western company can make, suggests Basil Vassiliou, who heads Rohm & Haas' European operations. For example, Rohm & Haas has had a joint venture in Yugoslavia since the early 1970s that it counts as a success in building sales—some 5% of the company's total sales are in Eastern Europe—and in getting to know the territory.

Akzo's East European experts note that the markets there offer a number of opportunities. One of the most important is that by restructuring the industries in the East bloc western companies can now approach customers there more directly and with more technical support. "This implies that customers can be treated in the way we do it in western markets as well," says one Akzo executive.

There is also opportunity, add officials at DSM, in providing western technology and managerial skills in exchange for products or for ownership of a project.

Rohm & Haas' Vassiliou agrees, but notes that caution is still needed: "How much money do you want to invest in this part of the world? You don't know the countries, so can you really take advantage of them? Can the people there solve their environmental problems? Can you get quality that will be acceptable? And how reliable is supply?"

Uncertainties in Eastern Europe, however, can be lived with more easily than those affecting general economic conditions in Europe during the coming year.

Third-quarter earnings of Western European chemical firms were poor primarily because of losses stemming from foreign currency translation and the large rise in raw material prices. In fact, unfavorable currency exchange rates more than offset any benefits resulting from

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hydrocarbon feedstocks being priced in weak U.S. dollars. Athough the cost of a barrel of crude oil was rising, the rise was denominated in weak dollars, so the net rise in costs to European petrochemical companies was not so steep as face value might indicate.

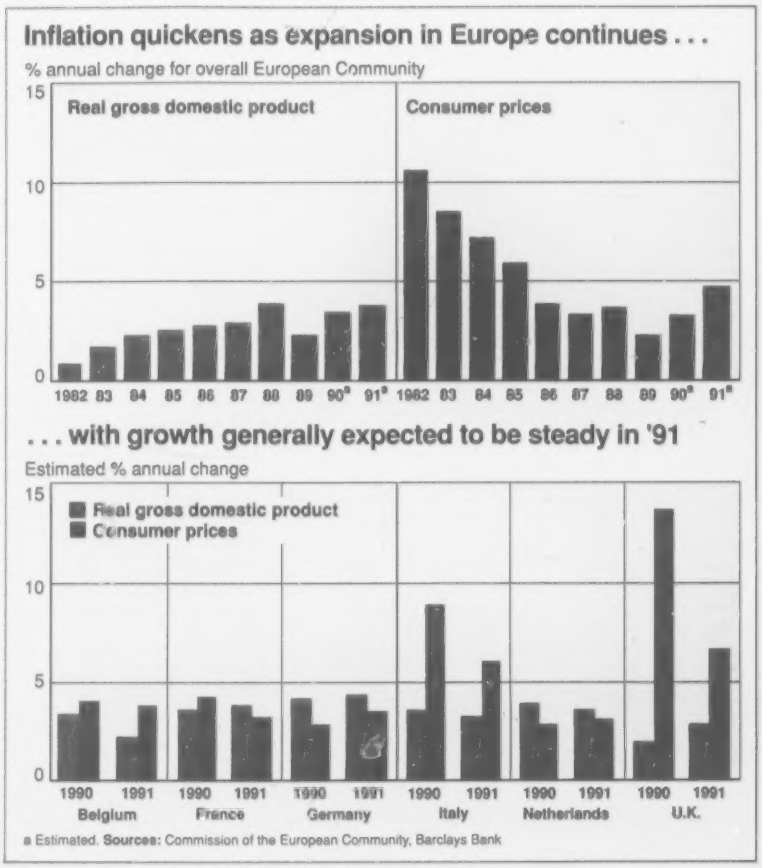
However, according to Alastair Kilgour, a chemicals analyst at BNP Securities in London, currency fluctuations and increases in raw material prices will have much less effect on chemical firms' earnings in 1991. Product prices also are rising, and both demand and capacity utilization have continued to be generally high.

Nonetheless, he adds, "We are cautious. The real key to profitability is capacity utilization. As this falls, the current pricing discipline in the market will come under increased pressure. We perceive the crunch coming in the first quarter 1991, when volumes could slow significantly."

Growth in demand will slow, adds Tony Church, an analyst with Wertheim Schroder, an investment securities firm in London, for one thing, because of the reaction of individual governments to rising inflation. "We believe that government action to control inflation in continental Europe will be harsh, leading to a more significant fall in the rate of economic activity than currently anticipated, thereby weakening demand," he says.

Given the slowing growth in demand, no apparent shortage of material, and the lack of a clear consensus on how producers are approaching price rises, Church believes that pressures on profit-margins of commodity chemical companies will increase sharply. Higher costs will be passed through to customers only with difficulty during the next three or four months, so that ultimately selling prices will fall short of full cost coverage.

He does point out one positive development, however. The potential slowdown in demand is causing a cutback in plans for new chemical plant construction around the world. Perhaps the primary example of this is Exxon Chemical's delay, by about two years, of a major expansion of its Fife ethylene plant at Mossmoran, Scotland, which it operates as a joint venture with Shell Chemical.


Inflation quickens as expansion in Europe continues . . .
% annual change for overall European Community
Real gross domestic product
Consumer prices
15
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1982 83 84 85 86 87 88 89 90a 91a 1982 83 84 85 86 87 88 89 90a 91a
. . . with growth generally expected to be steady in '91
Estimated % annual change
Real gross domestic product
Consumer prices
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Belgium France Germany Italy Netherlands U.K.
a Estimated. Sources: Commission of the European Community, Barclays Bank

This year will also see global trading patterns begin to change, a number of companies indicate. The major reason is that capacity continues to build up in the Far East, although there is doubt about the economic viability of some of the large projects there.

Corporate executives throughout Europe are watching for signs of downturn. For example, Hermann J. Strenger, chairman of Bayer, concludes that an economic slowdown already is under way in the U.K. and the U.S., with signs of one also appearing in Spain, Italy, France, and Scandinavia. Demand thus far remains buoyant, he says. But he sees excess capacity in some areas, coupled with upward pressure on selling prices from the soaring prices of crude oil and petrochemical feedstocks, as negative factors that companies must cope with.

Bayer, he says, will do everything it can to raise selling prices so as to pass along its higher costs to the market. At the same time, it is implementing cost-cutting measures to check rising costs in all areas, from maintenance to marketing and administration.

One of the problems faced by petrochemical companies, in particular, according to James Gordon, chemicals coordinator for Shell International Chemical, is that "prices for some if not most chemical products are still not at the same level, in real terms, that they were in 1988 despite a doubling of feedstock prices. That is causing a severe effect on margins." It's not such a bad situation for customers, he adds—"they are not in nearly as bad a squeeze." Companies like Shell, however, are "caught in the middle." □

Japan

Chemical boom may now be faltering

An end to Japan's 48 months of economic growth would mean problems for Japanese chemical companies

Earl V. Anderson
C&EN Northeast News Bureau

The heady price of membership in Japanese golf clubs is coming down—far and fast. Could this be a harbinger of economic trends for the nation's chemical industry, where golf club membership is considered a gold-plated investment as well as an expensive route to recreation?

It could be. The Japanese have just completed their 48th consecutive month of economic expansion, the longest period of growth for the country since a 57-month streak in the late 1960s. Now, however, the high oil prices triggered by Iraq's invasion of Kuwait threaten to halt Japan's current expansion binge.

Oil prices are not the only problem facing Japan's economy. In fact, an exceptionally strong yen has offset much of the impact of high world oil prices, which are set in dollars. Inflationary pressures, high interest rates, and an expected drop in capital spending are other culprits.

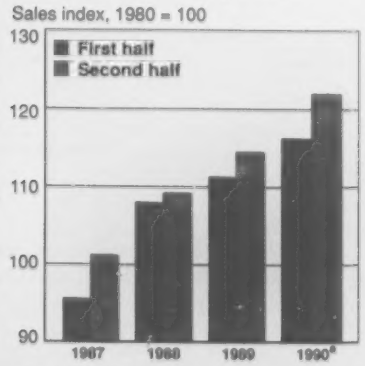
Inflation could dampen personal consumption, one of the engines that have kept Japan's economy growing at an estimated 4 to 6% this year. Rising interest rates, in addition, will mean higher payments for heavily leveraged Japanese companies. Business capital spending contributes about 20% to Japan's gross national product.

Government officials estimate that the economy will grow about 3% in fiscal 1991, which starts next April. But many Japanese business executives are skeptical. They suspect that economic growth may be halted altogether, or even reversed in coming months.

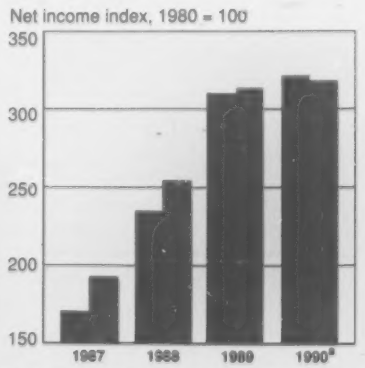
Japanese manufacturing companies must cope with these gathering storm clouds, and chemical companies are no exception. However, for the chemical industry, there is the added burden of high naphtha prices, the result of continuing tensions in the Middle East. Japan's petrochemical industry depends heavily on naphtha—particularly imported naphtha—for its feedstock.

As a result, many executives in Japanese chemical companies believe that the industry is sailing into much rougher economic seas. A recent survey conducted by the Japan Chemical Industry Association (JCIA) bears this out.

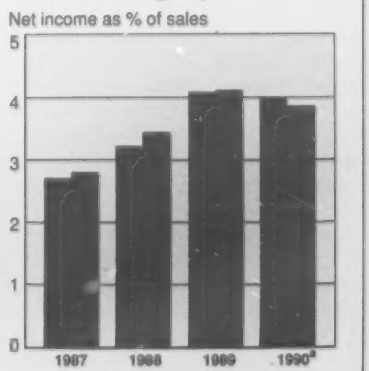
Sales continue to rise for chemical companies . . .



. . . but net income has leveled off . . .



. . . and profit margins are down slightly



Note: Based on the results of 12 leading Japanese chemical companies: Asahi Chemical Industry, Dainippon Ink & Chemicals, Hitachi Chemical, Mitsubishi Kasei, Mitsubishi Petrochemicals, Mitsui Toatsu Chemicals, Sekisui Chemical, Showa Denko, Sumitomo Chemical, Takeda Chemical Industries, Teijin, and Toray Industries. The fiscal year for most, but not all, of these Japanese companies ends March 31 of the following year. a Estimated for second half. **Source:** Toto Kwizai, Shinposha

The survey found that chemical production, sales, and profits have remained strong through the first three quarters of the year (or through the first half of Japan's fiscal 1990, which ends next March 31). Now, says JCIA, indexes for the chemical industry, particularly in the petrochemical and organic chemicals sectors, are declining.

The situation in the Middle East colors much of the JCIA survey. Most respondents believe that raw material costs will continue to escalate, which is bad for their businesses. The survey shows clearly that Japan's chemical industry has been faring very well. This is especially true of inorganic chemicals, and to a lesser extent for petrochemicals and organics.

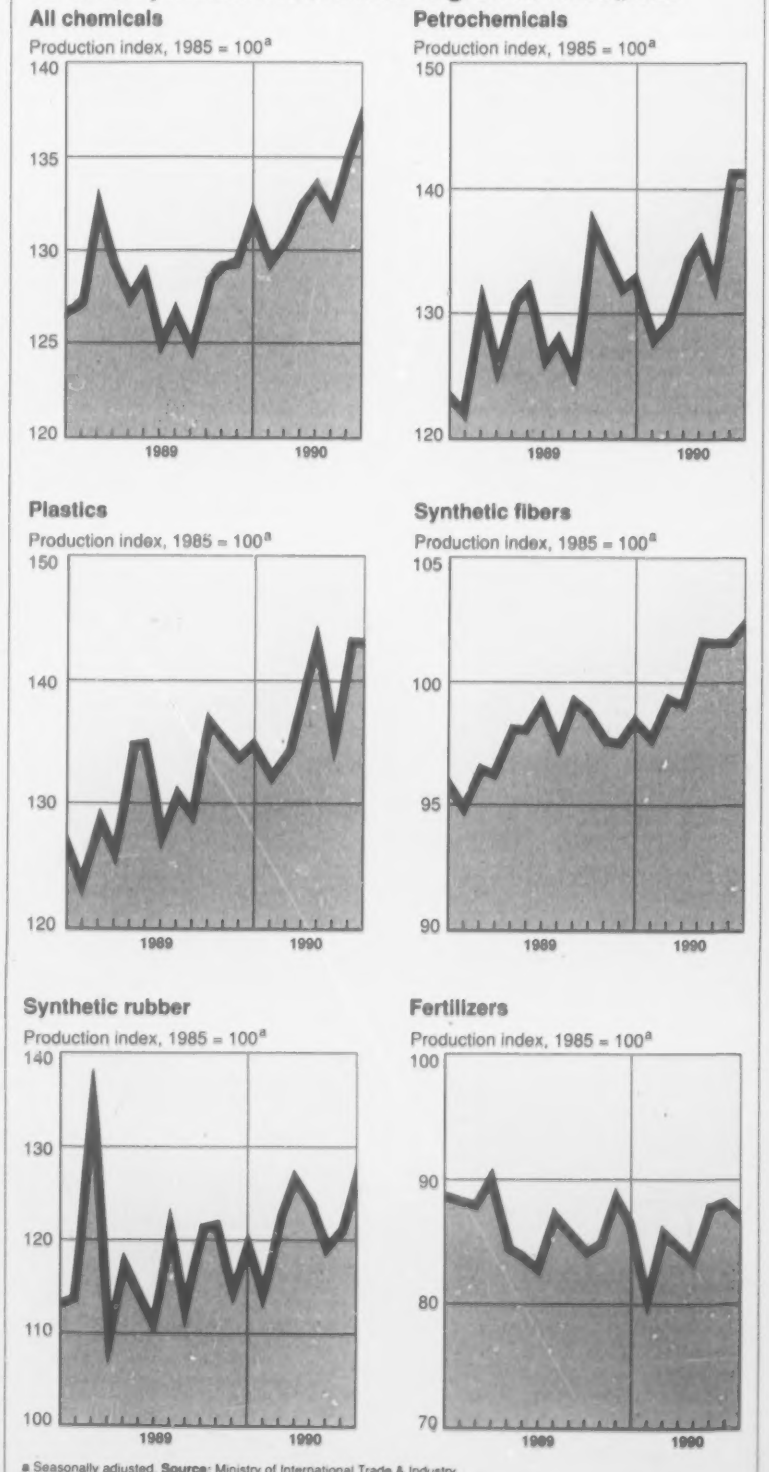
Chemical industry leaders aren't that optimistic about the future, however. According to JCIA, although most of them think that business conditions will remain unchanged throughout the quarter ending this month, the number thinking that way is far less than in the previous survey about three months ago. And those who think that the situation will take a turn for the worse far exceed those who think that it will improve.

What's more, the situation looks even worse to these Japanese chemical executives as they peer further out. More than half expect business conditions to get worse in the first quarter of 1991 (the last quarter of Japan's fiscal 1990). And although they concede that next year's second quarter is unpredictable, most think the situation then will be worse.

That's not an encouraging scenario, but chemical executives are not alone in their pessimism. According to another survey, the consensus of 267 Japanese manufacturing companies is that pretax profits in fiscal 1990 will decline 1%—this despite broadly higher profits in the first half, ending in September.

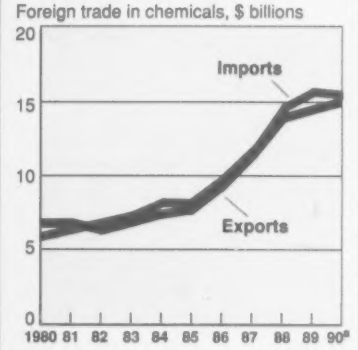
The survey conducted by Nihon Keizai Shimbun, a business newspaper publisher, reflects the general belief that growth in the economy will slow in 1991, after four years of expansion. It also indicates that even in the last three months of 1990, many companies have felt the impact of higher interest rates, a very

Chemical production continues to grow in most areas



[a] Seasonally adjusted. **Source:** Ministry of International Trade & Industry

Deficit in Japan's chemical trade narrows



a C&EN estimates.
Source: Ministry of International Trade & Industry

strong yen, higher crude oil prices, and the plunge in the Japanese stock market.

A C&EN index of the net income of 12 leading Japanese chemical companies confirms this trend, as far as the chemical industry is concerned. Their profits rose 3% in the first half of fiscal 1990 but will decline about 1% in the second half. That's certainly not a wipeout. But it isn't a welcome prospect, either, to a chemical industry whose profits have jumped 112% since the second half of fiscal 1986, while sales increased only 28%.

Until very recently, the Japanese chemical industry had been on a roll. In some cases, it was cranking out record volumes of material and still couldn't meet demand.

Last year, for instance, it produced a record 5.6 million metric tons of ethylene. Through August 1990, output was 4% ahead of last year's pace. If that rate of growth is maintained, ethylene production could hit 5.8 million metric tons in 1990. But domestic demand is estimated to be 5.7 million metric tons this year, and that doesn't include exports.

Styrene is another of several petrochemicals that are in tight supply in Japan, even though they are heading for record production levels. For styrene, in fact, the shortage is acute. As of a month ago, stocks were less than two months' supply.

Because of this market tightness, Japanese chemical companies are building or planning major expansions in ethylene and many other major petrochemicals. Now many are wondering if they may have to relearn the lesson of bringing on large chunks of new capacity just when the market is topping out.

Meanwhile, petrochemical producers have been able to raise prices on many products to compensate for higher naphtha costs. But if demand starts dropping, price increases could be hard to come by. And price increases are something the Japanese chemical industry can ill-afford to lose. In October, naphtha costs in Japan rose above $400 per metric ton, $100 higher than a month earlier.

Some ethylene producers are switching from imported to domestic naphtha. But that ploy can do only so much good. First, domestic naphtha still must be produced from expensive imported crude oil. And although the chemical industry has already doubled its reliance on domestic naphtha from 5% to 10%, it still means that 90% of its requirements must be met by imports. □

Production of plastics continues to show strong growth

Thousands of metric tons unless otherwise indicated	1989	Eight months 1990	Eight months 1989	% change
INORGANIC CHEMICALS				
Ammonia	1831	1213	1225	-1%
Ammonium chloride	274	169	195	-13
Ammonium sulfate	1717	1212	1147	6
Calcium carbide	344	201	240	-16
Calcium superphosphate	454	321	303	6
Carbon black	779	516	513	1
Chlorine, liquid	1009	686	679	1
Hydrochloric acid	571	395	368	7
Nitrogen[a]	7876	5436	5134	6
Oxygen[a]	8384	5733	5462	5
Sodium carbonate	1105	758	748	1
Sodium hydroxide	3674	2568	2417	6
Sodium silicate	756	508	479	6
Sulfuric acid	6885	4546	4549	0
Titanium dioxide	275	185	181	2
ORGANIC CHEMICALS				
Acetaldehyde	356	245	237	3
Acetic acid	432	292	274	7
Acetone	337	230	219	5
Acrylonitrile	611	385	398	-3
Benzene[b]	2672	1948	1791	9
Butadiene	827	543	541	0
Butanol	291	190	186	2
Caprolactam	469	345	315	10
Cyclohexane	656	437	438	0
Dioctyl phthalate	293	190	192	-1
Ethylene	5602	3797	3648	4
Ethylene dichloride	2464	1759	1613	9
Ethylene glycol	548	342	325	5
Ethylene oxide	681	451	421	7
Methanol	82	62	64	-3
Octanol	285	174	191	-9
Phenol	423	282	275	3
Phthalic anhydride[b]	160	199	105	90
Propylene	4012	2757	2624	5
Propylene glycol	285	193	182	6
Styrene	1990	1372	1314	4
Terephthalic acid	1200	866	810	7
Toluene	1075	726	693	5
Toluene diisocyanate	104	70	66	6
Urea	810	507	537	6
Xylene	2488	1749	1626	8
PLASTICS				
Phenolic resins	375	250	248	1
Polyethylene	2712	1909	1739	10
Polypropylene	1719	1260	1101	14
Polystyrene	1997	1356	1305	4
Polyvinyl chloride	1972	1332	1289	3
SYNTHETIC RUBBER	1352	949	906	5

a Millions of cubic meters. b Petroleum-based product only. **Source:** Ministry of International Trade & Industry

Chemical companies slide into recession

Sales and earnings are hurt by sagging domestic economy and strong Canadian dollar

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Canadian chemical companies are ending up 1990 with a lot on their minds. There is the new Canadian goods and services tax (GST). Then there's the question of Quebec's future relationship with the rest of Canada.

And, of course, there's the current recession.

Barring political complications, the highly controversial GST will go into effect Jan. 1. If it does, prices will change for a wide range of products and services.

GST, a multistage, value-added tax similar to that used in many European countries, will replace the current manufacturers' sales tax. Unlike many consumers in Canada, the export-oriented Canadian chemical industry generally supports GST because it expects the tax to benefit exporters. However, there are a lot of unknowns involved in changing any tax system, especially a change as dramatic as this one.

Also unknown is the future of Quebec. Since the collapse of the Meech Lake package of constitutional reforms in June, Quebec has been debating whether to remain a part of Canada, seek independence, or find some ground in between. The outcome must at least await the results of a Quebec national assembly committee study on the province's constitutional future, due late next March.

What is known, however, is the impact of the recession in Canada on the fortunes of Canadian chemical companies. It isn't good.

Canadian business executives have believed for some time that they were plowing through a recession. Now, it's official. No less a government official than finance minister Michael Wilson acknowledged in October that Canada is, indeed, in a recession.

Wilson does not expect the recession to be severe. Others aren't that sanguine. A *Financial Post* survey of Canadian economists showed that they think the present downturn will be "fairly long and deep," lasting more than one year. It's a far more pessimistic view than they expressed only four months ago.

The downturn in the Canadian economy started in the second quarter. Economists can't agree when it will end. Some look for the economy to bottom out in the second or third quarter of 1991. Others bet on the end of 1991. Still others believe that the slump will continue on into 1992. At least part of this pessimism is based on the belief that the Bank of Canada will keep its interest rates high to combat inflation.

Numbered among the pessimists are several Canadian chemical company executives. J. Edward Newall, chairman and chief executive officer of Du Pont Canada, says, "We expect that the recession in the North American manufacturing sector will continue well into 1991. The overvalued Canadian dollar [which hampers exports], high interest rates, and rising energy and raw material prices are making business difficult for us and our customers."

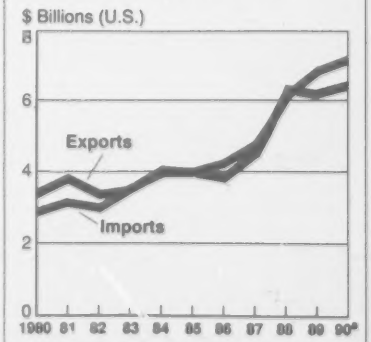
W. Norman Kissick, chairman of Union Carbide Canada, agrees. He says that, with the Middle East situation significantly increasing petrochemical raw material costs and with the Canadian economy deteriorating, "the outlook remains difficult."

They have reason to be less than confident about the immediate future. Du Pont Canada's sales for the first nine months were up only 1% from the year-earlier period, while net income was down a hefty 33%.

Carbide Canada saw its sales drop 3.5% during this year's first nine months and its net income plummet 68%. Many other Canadian chemical companies are in the same boat. At Celanese Canada, for instance, both sales and profits were down 8%. Gerald Elden, president of Celanese Canada, adds: "Margins are suffering and cost increases may not be recoverable in the short term."

Du Pont Canada's Newall notes that, although domestic demand continues to weaken and domestic

Deficit persists for Canada's chemical trade balance



a C&EN estimates. Source: Statistics Canada

More gains than losses in chemical output this year

Thousands of metric tons	Production 1990[a]	1989	1988	1987	1986	% change 1989–90
Ammonia	3520	4054	4010	3512	3540	–13%
Ammonium nitrate	1030	1056	981	844	948	–2
Ammonium phosphate	na	952	986	941	1149	na
Benzene	760	670	695	720	635	13
Chlorine	1550	1592	1664	1635	1536	–3
Ethylene	2350	2317	2346	2140	1909	1
Hydrochloric acid, 100%	185	180	180	164	153	3
Phosphoric acid, 100%	400	470	475	464	547	–15
Polyethylene, high density	325	293	311	269	242	11
Polyethylene, low density	1160	1008	1105	1021	887	15
Propylene	755	719	669	628	628	5
Sodium chlorate	650	593	503	432	373	10
Sodium hydroxide	1550	1542	1720	1770	1696	1
Sulfuric acid	3260	3560	3805	3437	3536	–8
Toluene	420	397	417	396	393	6
Urea	2445	2402	2372	2142	2330	2

a C&EN estimates. na = not applicable. **Source:** Statistics Canada

revenues were down 14% in the third quarter, the company's exports were up 35%.

In fact, Canadian exports of chemicals will increase this year, although not so much as Du Pont Canada's did. They are likely to rise 5% (based on Canadian dollars) to the equivalent of $6.5 billion in U.S. currency. Imports, meanwhile, will advance only 3% to $7.2 billion. This will shave $30 million off the chemical trade deficit, which was $815 million (U.S. dollars) last year.

Higher export volumes, despite the strong Canadian dollar, have helped to offset weak domestic markets, making it possible for Canadian companies to increase production of some chemicals this year. This is particularly true of the major synthetic resins. Such increases would not be possible by supplying the Canadian domestic market alone. Nevertheless, output of ethylene derivatives is expected to nudge ethylene production up only about 1% this year to 2.35 million metric tons.

Aromatics are faring much better. Benzene and xylene production are up strongly in Canada this year. Toluene output is advancing more modestly, however. The reason for the strong showing in aromatics: growing demand for octane enhancers that help refiners comply with the phase-out of the use of lead in Canadian gasoline.

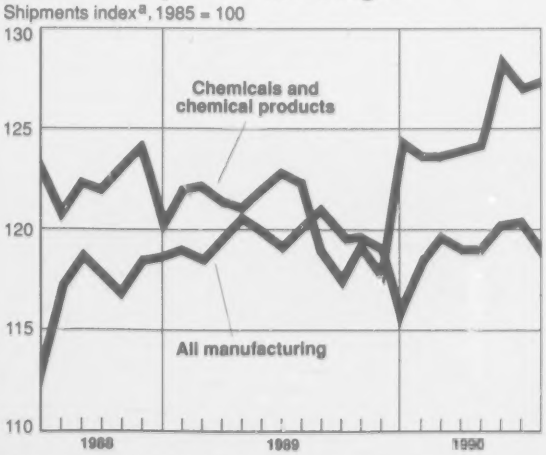
Not so fortunate are Canadian fertilizer producers. Ammonia production, for instance, will drop about 13% this year and ammonium nitrate output will decline 2 to 3%, while urea production will inch upward only 2%.

Weak pulp and paper markets, meanwhile, plus a change in that industry's technology, are hurting several inorganic chemicals. For instance, chlorine consumption—and output—is down because pulp mills are trying to eliminate emissions of chlorinated organic compounds.

In addition to riding out the recession, Canadian chemical firms will have to focus on three important trade issues next year. One is the Uruguay round of trade negotiations sponsored by the General Agreement on Tariffs & Trade. Another is the list of chemicals it may recommend for a new round of accelerated tariff cuts under the Canada-U.S. free trade agreement. And third is the upcoming free trade talks between the U.S. and Mexico. □

Chemical shipments move higher . . .

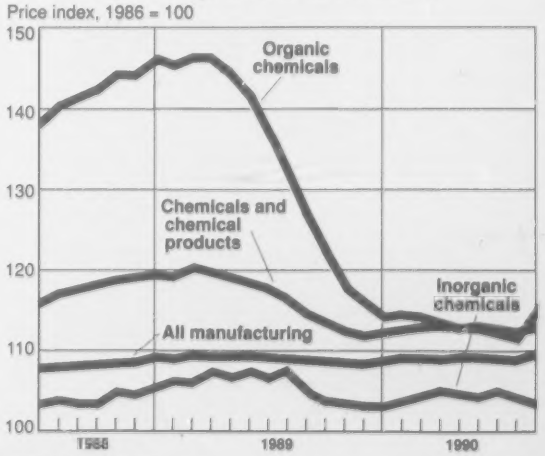
Shipments index[a], 1985 = 100



a Seasonally adjusted. **Source:** Index based on Statistics Canada shipments data

. . . as chemical prices remain weak

Price index, 1986 = 100



Source: Statistics Canada